What is claimed is:

1. An apparatus for transporting a fluid, comprising:

   a channel for receiving a fluid;

   a sensor for determining an internal condition of the fluid in the channel; and

   a channel actuator in communication with the sensor for changing a cross-sectional area of the channel based on the internal condition, wherein the change in cross-sectional area controls a parameter selected from a pressure and a fluid flow.

2. The apparatus of claim 1, wherein the channel actuator is selected from a piezoelectric actuator and a capacitive actuator.

3. The apparatus of claim 1, wherein the channel comprising a plurality of channels.

4. The apparatus of claim 3, wherein at least two of the channels comprising a separate actuator for changing the cross-sectional area of each channel.

5. The apparatus of claim 3, wherein at least two of the channels share the same actuator for changing the cross-sectional area of each channel.

6. The apparatus of claim 1, wherein the channel is a microchannel.

7. The apparatus of claim 1, wherein the channel actuator is responsive to an alternating current actuation signal and a direct current bias signal.

8. The apparatus of claim 1, further comprising:

an atomizer including, a first reservoir for receiving the fluid, an atomizer actuator disposed in communication with the first reservoir for generating an acoustical pressure wave through the fluid, and a first set of ejectors including at least one ejector for dispensing atomized fluid in response to the acoustical pressure wave.

9. The apparatus of claim 8, further comprising:

a reactor selected from a reverse-flow micro-reactor and a unidirectional-flow micro-reactor.

10. The apparatus of claim 1, further comprising:

a reactor is selected from a reverse-flow micro-reactor and a unidirectional-flow micro-reactor.

11. The apparatus of claim 8, wherein the channel comprising:

a first end for receiving a fluid from a fluid reservoir; and

a second end for delivering the fluid to the atomizer.

12. The apparatus of claim 9, wherein the channel comprising:

a first end for receiving a fluid from a fluid reservoir; and

a second end for delivering the fluid to the reactor.

13. The apparatus of claim 1, wherein the channel is integrated with a fuel cell.

14. The apparatus of claim 10, wherein the channel is integrated with a membrane in the reactor.

15. An atomizer, comprising:

a first reservoir for receiving a fluid;

an atomizer actuator disposed in communication with the first reservoir for generating an acoustical pressure wave through the fluid; and

a first set of ejectors including at least one ejector for dispensing atomized fluid in response to the acoustical pressure wave.

16. The atomizer of claim 15, further comprising:

a reactor selected from a reverse-flow micro-reactor and a unidirectional-flow micro-reactor.

17. The atomizer of claim 15, wherein the atomizer actuator is selected from a piezoelectric actuator and a capacitive actuator.

18. The atomizer of claim 17, wherein the atomizer actuator operates in a range from about 100kHz to 100MHz.

19. The atomizer of claim 15, wherein the ejector has a structure for focusing acoustic waves, and wherein the structure is selected from a horn structure and a pyramidal structure.

20. The atomizer of claim 15, further comprising:

a second reservoir for receiving the fluid, the atomizer actuator disposed in communication with the first reservoir for generating an acoustical pressure wave through the fluid in the first reservoir and second reservoir; and

a second set of ejectors including at least one ejector for dispensing atomized fluid in response to the acoustical pressure wave disposed, wherein the second set of ejectors is disposed on opposite side of the atomizer actuator as the first set of ejectors.

21. The atomizer of claim 15, further comprising at least two sets of ejectors and at least two atomizer actuators for activating the at least two ejector nozzles.

22. The atomizer of claim 15, further comprising at least two atomizers.

23. The atomizer of claim 22, further comprising a pressure sensor for controlling each atomizer.

24. The atomizer of claim 15, wherein the atomizer having at least one set of ejectors disposed on opposing sides of the atomizer actuator.

25. The atomizer of claim 15, wherein the at least one ejector nozzle further comprising a structure for focusing an acoustic wave at a tip of the at least one ejector nozzle.

26. The atomizer of claim 25, wherein the structure selected from a horn structure and a pyramidal structure.

27. The atomizer of claim 26, wherein the horn structure having an internal cavity that expands from a tip according to at least one function selected from a linear function and an exponential function.

28. The atomizer of claim 25, wherein the structure formed by at least one of chemical etching and physical machining of a solid substrate.

29. The atomizer of claim 15, wherein each of the at least one ejector nozzles being individually activated.

30. The atomizer of claim 15, wherein the at least one ejector nozzle having a tip through which an opening may be formed.

31. The atomizer of claim 15, further comprising a fuel cell.

32. The atomizer of claim 31, wherein the atomizer and the fuel cell are directly integrated.

33. The atomizer of claim 15, further comprising:

a storage reservoir for storing the fluid.

34. The atomizer of claim 33, wherein the storage reservoir comprising a separate reservoir for delivering the fluid to the atomizer.

35. The atomizer of claim 34, wherein the separate reservoir is selected from a disposable cartridge and a refillable cartridge.

36. The atomizer of claim 34, wherein the separate reservoir comprising a pressurized cartridge for storing the fluid in a pressurized environment.

37. The atomizer of claim 36, wherein the atomizer controls a pressure of the pressurized cartridge using the atomizer actuator.

38. The atomizer of claim 15, wherein the fluid is selected from a liquid, a gas, a fluidized polymer, liquid with solid particles, a gas with solid particles, and combinations thereof.

39. The apparatus of claim 15, wherein the atomizer is integrated with a membrane in the reactor.

40. A reactor, comprising at least one internal channel for transporting a fluid in a first direction and a second direction.

41. The reactor of claim 40, wherein the at least one internal channel comprising a catalyst disposed along an internal surface for reacting with the reactant.

42. The reactor of claim 41, wherein the catalyst is disposed along the internal surface of the internal channel in a discontinuous pattern comprising a fractal pattern.

43. The reactor of claim 40, wherein the reactor is selected from a reverse-flow micro-reactor and a unidirectional-flow micro-reactor.

44. The reactor of claim 40, wherein the reactor comprising a rotating reactor design.

45. The reactor of claim 44, wherein the reactor further comprising a mixing chamber for mixing the fluid, the mixing chamber rotated about an axis to accomplish flow reversal of the fluid through the at least one internal channel.

46. The reactor of claim 45, wherein the reactor further comprising a reaction chamber disposed within the mixing chamber, whereby heat from the reaction chamber is used to heat the fluid in the mixing chamber.

47. The reactor of claim 45, wherein the mixing chamber selected from a spiral configuration and a swiss roll configuration.

48. The reactor of claim 46, wherein the reaction chamber selected from a spiral configuration and a swiss roll configuration.

49. The reactor of claim 45, wherein the reactor further comprising:

a first plate in communication with the at least one internal channels and having openings for biasing a flow of the fluid in the first direction and the second direction; and

a second plate mounted to slide along the first plate between a first position and a second position with respect to the openings, wherein when the second plate is in the first position, the fluids flow in the first direction and when the second plate is in the second position, the fluids flow in the second direction.

50. The reactor of claim 45, wherein the reactor further comprising:

a third plate disposed between the first plate and the second plate, the third plate having openings for the flow of the fluid, the third plate further including a seal disposed between the first plate and the second plate for preventing a leakage of the fluid.

51. The reactor of claim 40, wherein the reactor comprising a planar plate reactor design.

52. The reactor of claim 51, wherein the reactor further comprising:

a first plate in communication with the at least one internal channels and having openings for biasing a flow of the fluid in the first direction and the second direction;

a second plate mounted to slide along the first plate between a first position and a second position with respect to the openings, wherein when the second plate is in the first position, the fluids flow in the first direction and when the second plate is in the second position, the fluids flow in the second direction; and

a third plate disposed between the first plate and the second plate, the third plate having openings for the flow of the fluid, the third plate further including a seal disposed between the first plate and the second plate for preventing a leakage of the fluid.

53. The reactor of claim 40, wherein the reactor comprising a tubular reactor design.

54. The reactor of claim 48, wherein the at least one internal channel comprising:

a first internal channel having a first valve disposed at a first end and a second valve at a second end, the first valve and the second valve for biasing the flow of the fluid through the first internal channel;

a second internal channel having a third valve disposed at a third end and a fourth valve disposed at a fourth end, the third valve and the fourth valve for biasing the flow of the fluid through the second internal channel.

55. The reactor of claim 40, wherein the reactor further comprising:

a membrane for separating a fuel from the fluid, wherein the fuel is derived from the fluid.

56. The reactor of claim 55, further comprising:

a fuel cell in fluid communication with the reactor, wherein at least one channel of the fuel cell is disposed adjacent the membrane, wherein the membrane is permeable to the fuel and not substantially permeable to the fluid, and wherein the fuel cell is adapted for generating electricity from the fuel.

57. The reactor of claim 56, wherein the membrane is a proton conducting membrane having a catalyst disposed thereon for reacting with the fuel.

58. The reactor of claim 57, wherein the fuel cell includes an anode and a cathode adjacent the membrane for generating an electrical current from the reaction of the fuel with the catalyst.

59. The reactor of claim 57, wherein the catalyst disposed on the proton conducting membrane is in a discontinuous pattern comprising fractal pattern.

60. The reactor of claim 56, further comprising at least one internal channel for transporting the fuel to the fuel cell, wherein the internal channel includes the internal channel for receiving the fuel, a sensor for determining an internal condition of the fuel in the internal channel, and a channel actuator in communication with the sensor for changing a cross-sectional area of the internal channel based on the internal condition, wherein the change in cross-sectional area controls a parameter selected from pressure and fluid flow.

61. The reactor of claim 55, wherein the membrane comprising a hydrogen separating membrane, and wherein the fuel comprises a hydrogen containing gas.

62. The reactor of claim 60, wherein the reactor further comprising:

a mixing chamber for mixing the fuel prior to transportation of the fuel to the at least one internal channel.

63. The reactor of claim 40, further comprising at least one valve for selecting the first direction and the second direction for the flow of the reactant.

64. The reactor of claim 43, wherein the reverse-flow reactor includes:

a reverse-flow channel having a first end and a second end, the first end and the second end are disposed on opposite ends of the reverse-flow channel;

a first inlet for dispensing the reactant at the first end of the reverse-flow channel in a first direction along of the reverse-flow channel;

a second inlet for dispensing the reactant at the second end of the reverse-flow channel in a second direction along the reverse-flow channel opposite the first direction; and

a membrane disposed between the reverse-flow channel and a second channel, wherein the membrane is adapted to catalytically generate a fuel from the reactant.

65. An integrated fuel processing apparatus comprising:

an atomizer, including:

a first reservoir for receiving a reactant,

an atomizer actuator disposed in communication with the first reservoir for generating an acoustical pressure wave through the reactant, and

a first set of ejectors including at least one ejector for dispensing atomized reactant in response to the acoustical pressure wave; and

a reactor fluidically coupled to the atomizer, including:

at least one internal channel for transporting the reactant in a first direction and a second direction to produce a fuel.

66. The apparatus of claim 65, further comprising at least one channel system fluidically couples the fluid to a receiving apparatus selected from the atomizer and the reactor, wherein the channel system includes:

a channel for receiving a reactant,

a sensor for determining an internal condition of the fluid in the channel, and

a channel actuator in communication with the sensor for changing a cross-sectional area of the channel based on the internal condition, wherein the change in cross-sectional area controls a parameter selected from a pressure and a fluid flow.

67. The apparatus of claim 66, wherein the reactant is selected from a liquid and a gas.

68. The apparatus of claim 66, wherein the reactant is selected from methanol, methane, a hydrocarbon, and combinations thereof.

69. The apparatus of claim 66, wherein the atomizer actuator is selected from a piezoelectric actuator and a capacitive actuator.

70. The apparatus of claim 69, wherein the channel actuator is selected from a piezoelectric actuator and a capacitive actuator.

71. The apparatus of claim 66, wherein the channel comprising a plurality of channels.

72. The apparatus of claim 65, wherein the reactor is selected from a rotating reactor design, a planar plate reactor design, and a tubular reactor design.

73. The apparatus of claim 65, wherein the reactor further comprising:

a membrane for separating a fuel from the reactant, wherein the fuel is derived from the reactant.

74. The apparatus of claim 65, further comprising:

a fuel cell in fluid communication with the reactor and wherein the fuel cell is adapted for generating electricity from the fuel.

75. An integrated fuel processing apparatus comprising:

an atomizer, including:

a first reservoir for receiving a reactant,

an atomizer actuator disposed in communication with the first reservoir for generating an acoustical pressure wave through the reactant, and

a first set of ejectors including at least one ejector for dispensing atomized reactant in response to the acoustical pressure wave; and

a reactor comprising a catalytically active membrane fluidically coupled to the atomizer.

76. A method, comprising:

providing an atomizer having at least one ejector nozzle, at least one atomizer reservoir, and at least one actuator, wherein the atomizer reservoir is disposed between the ejector nozzle and the actuator;

activating the actuator to generate an acoustical pressure wave for forcing the reactant through the ejector nozzle; and

atomizing the reactant to produce an atomized reactant.

77. The method of claim 76, further comprising:

mixing the atomized reactant with a gas;

transferring the atomized reactant/gas to a reactor, wherein the reactor includes a membrane and a channel having a catalyst disposed thereon, and wherein the membrane bounds the channel on at least one side;

forming a fuel and reaction products by reacting the atomized reactant/gas and catalyst in the channel; and

separating the fuel from the atomized reactant/gas and reaction products using the membrane to produce a substantially pure fuel steam.

78. The method of claim 76, further comprising:

collecting the fuel in a second channel of a fuel cell; and

generating electricity from the fuel.

79. The method of claim 76, further comprising:

focusing the acoustical pressure wave with a structure of the atomizer.

80. The method of claim 76, further comprising:

providing at least one channel that fluidically couples the atomizer and a reactant storage reservoir, wherein the channel includes a flexible membrane responsive to a signal to expand and contract a cross-sectional area of the channel; and

transferring the reactant to the atomizer from the storage reservoir by causing the flexible membrane to contract the cross-sectional area of the channel.

81. The method of claim 77, further comprising:

providing at least one channel that fluidically couples the atomizer and the reactor, wherein the channel includes a flexible membrane responsive to a signal to expand and contract a cross-sectional area of the channel; and

transferring the reactant to the reactor from the atomizer after atomizing the reactant by causing the flexible membrane to contract the cross-sectional area of the channel.

82. The method of claim 77, further comprising:

introducing the atomized reactant/gas to the reactor in a first direction at a first end of the reactor along the membrane; and

introducing the atomized reactant/gas to the reactor in a second direction at a second end of the reactor along the membrane, wherein introducing the atomized reactant/gas in the first direction and the second direction is alternated to achieve a forced unsteady-state operation of the reactor.

83. A method of moving a fluid, comprising:

providing at least one channel that fluidically couples a first structure to a second structure, wherein the channel includes a flexible membrane responsive to a signal to expand and contract a cross-sectional area of the channel; and

transferring the fluid to the second structure from the first structure by causing the flexible membrane to contract the cross-sectional area of the channel while the channel is under a constant parameter selected from a pressure and a flow rate.

84. A method of reverse-flow in a reactor, comprising:

providing a reactor having at least one internal channel for transporting a reactant in a first direction and a second direction to produce a fuel, wherein the reactor includes a catalyst disposed on the reactor;

introducing the reactant to the reactor in a first direction at a first end of the reactor; and

introducing the reactant to the reactor in a second direction at a second end of the reactor along the membrane, wherein introducing the reactant in the first direction and the second direction is alternated to achieve a forced unsteady-state operation of the reactor, and wherein the reactant reacts with the catalyst to produce the fuel.

85. A method, comprising:

controlling a pressure through flow rate in a system using an actuator.